Down-regulation of a pectin acetylesterase gene modifies strawberry fruit cell wall pectin structure and increases fruit firmness

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Antisense-mediated down-regulation of several fruit-specific genes has previously demonstrated how the cell wall disassembly in strawberry fruit is mediated by a series of enzymes that act sequentially (Posé et al. 2011). An interesting example, the silencing of the polygalacturonase gene FaPG1, was also related with a significant increase of the post-harvest strawberry fruit firmness (Posé et al. 2013). Our research group has isolated a pectin acetylesterase gene, FaPAE1, which expression is enhanced during strawberry ripening. The main goal of this work was to elucidate the role of the degree of acetylation in cell wall integrity and fruit firmness through the antisense-mediated down-regulation of FaPAE1 in strawberry plants. Several transgenics lines were generated and 5 of them produced fruits 5-15% firmer than controls. Cell wall from ripe fruits was isolated from two independent transgenic lines and a control line, and sequentially extracted with different solvents (PAW, H2O, CDTA, Na2CO3). Modifications in fraction yield, its sugar composition and the degree of acetylation in each fraction were determined. Higher amounts of CDTA and Na2CO3 fractions were obtained in transgenic fruits, suggesting a decreased pectin solubilization as results of FaPAE1 silencing. Accordingly, the degree of acetylation of the Na2CO3-soluble pectins was greater in the transgenic lines than the control, but the opposite result was found in pectins from the CDTA fraction. These results suggest that PAE is preferentially active in pectis that are tightly bound to the cellulose-hemicellulose network and its activity could reduce the complexity of the cell wall structure, allowing that other hydrolytic enzymes could access the pectin chains. Thus, the increased fruit firmness observed in the transgenic FaPAE1 lines could be attributed to the direct effect of the silencing of the PAE enzyme and also to the indirect effect that the increase of the degree of acetylation of pectins has on the activity of other enzymes involved in the cell wall degradation.

* Posé et al. (2011). Genes, Genomes and Genomics, 5 (Special Issue 1):40-48

* Posé et al. (2013). Plant Physiology, 150: 1022-1032

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